TENMARS

HEAT STRESS WBGT METER

TM-188 / TM-188D

User's Manual

CE

HB2TM18800000

TENMARS ELECTRONICS CO., LTD

1. Preface 2
2. General Description 2
3. Specifications (23℃±5℃) 4
4. Instrument Description 8
5. LCD Description 9
6. Power On/Off 10
7. Auto Power Off 10
8. Alarm On/Off 10
9. Disable Auto Power Off 11
10. LED Backlight 11
11. Temperature Unit 11
12. Mode 12
13. Data Hold 13
14. Single Data Record 13
15. Viewing Data Records 14
16. AUTO DATA LOGGER(TM-188D) 15
17. Maximum/Minimum (MAX/MIN) 16
18. USB (TM-188D) 16
19. Setting and Calibration 17
20. Thermal hazard prevention standards 24
21. Precautions 25
22. Software installation (TM-188D) 25
23. Computer grade 26
24. External DC power 26
25. Safety and maintenance standards 27
26. Battery replacement 27
27. End of life 28

1. Preface

Thank you for purchasing our product. Please, read the operating instructions in details before you use this HEAT STRESS WBGT meter, so you will operate the meter correctly. This meter can be operated in industry and home.

⚠	**WARNING**
	Non-compliance warning and/or operating instructions may damage the instrument or its parts or injuring the operator.

2. General Description

- Quick-response capacitance sensor. Accurate measurement for wet bulb globe temperature(WBGT), black globe temperature(TG),humidity(%RH), air temperature(TA),wet bulb(WET)and dew point(DEW).
- Max/Min and data hold.
- Low battery indication "⊟".
- LCD display with LED backlight.
- Single data record (TM-188 is able to record 50 data).

- Viewing data records.
- Switch the temperature unit to ℃ or ℉.
- Brass black ball in 50mm diameter.
- WBGT alarm setting.
- Auto power off with disable function.
- Interface: USB PC serial interface.(TM-188D)
- Data logging capacity :12000 records.(TM-188D)
- Sampling interval: Max 24 hours; Min 1 Second. (TM-188D)
- In order to measure the WBGT index, you should refer to the following regulations:

  ISO7243 : Hot environments. Estimation of the heat stress on working man.

  ISO7726 : Ergonomics of the thermal environment-instruments for measuring physical quantities.

3. Specifications (23℃±5℃)

Wet bulb globe temperature (WBGT)

Unit		Range	Resolution	Accuracy @15~40℃
indoor & Outdoor without sunlight	℃	0~59.0	0.1	±1.0
	℉	32.0~138.0	0.1	±1.8
Outdoor With sunlight	℃	0~56.0	0.1	±1.5
	℉	32.0~132.0	0.1	±2.7

※indoor & outdoor without sunlight:
WBGT = (0.7×WET)+(0.3×TG)
Outdoor with sunlight:
WBGT=(0.7×WET)+(0.2×TG)+(0.1×TA)

Air temperature (TA)

Unit	Range	Resolution	Accuracy @15~40℃
℃	0~50.0	0.1	±0.8
℉	32.0~122.0	0.1	±1.5

Black globe temperature (TG)

Unit	Range	Resolution	Accuracy @15~40℃
℃	0~80.0	0.1	±0.6
℉	32.0~176.0	0.1	±1.1

Relative Humidity (%RH)

Measurement Range	1%~99%
Accuracy	±3.0%RH(20~80%) ±5.0%RH(<20%,>80%)
Resolution	0.1%

Dew point temperature (DEW)

Unit	Range	Resolution
℃	-35.3~48.9	0.1
℉	-31.5~120.1	0.1
The value is calculated from the RH and Air temperature.		

Wet bulb temperature (WET)

Unit	Range	Resolution
℃	-21.6~50.0	0.1
℉	-6.9~122.0	0.1
The value is calculated from the RH and air temperature.		

- Dimension : 243 x 70 x 50mm (L x W x H).
- Weight : 220g. (Without batteries).
- Sampling Rate : one times per second.
- Power supply : 006P 9V,or AC100~240V DC 9V/ 0.5A(9mm).
- Battery life : 200 hours.
- Operating Temperature & Humidity : 0°C to +50°C, <95%RH. (Non-condensing)
- Storage temperature & humidity : -10°C to +50°C, <70% RH. (Non-condensing)
- Data output :USB PC serial interface(TM-188D)
- LCD: 52mm(W)x36mm(L) monochrome LCD and backlight.
- Standard accessories: 006P 9V battery x1. User's manual x 1. Carrying x1. USB cable(TM-188D) x1. AC100~240V toDC9V/0.5A(9mm)x1(TM-188D) x1. Install CD disk(TM-188D) x1.

WARNING

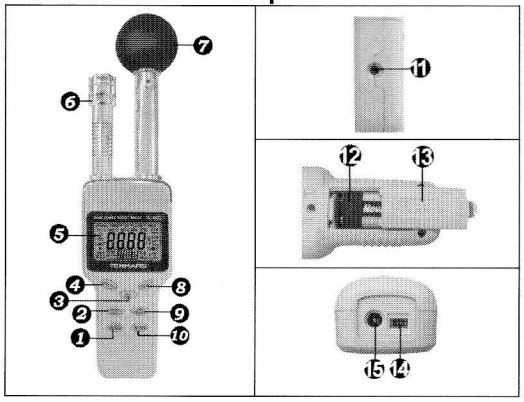
Please place the meter in the environment of high temperature and low humidity for 24 hours after used the meter in the humid environment.

WARNING

In order to ensure the accuracy of this meter, we strongly recommend send the meter back to original factory for maintenance every year.

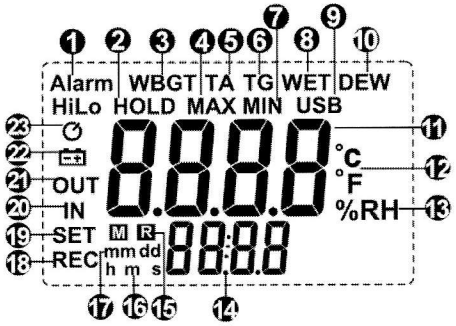
- EMC : This test was designed in accordance with EMC Standards in force and its compatibility has been tested in accordance with EN61326-1(2006).

4. Instrument Description



1. UP/MAX/MIN
2. MODE/SET
3. Power/Auto power off
4. UNIT/HOLD
5. LCD
6. Temp & humidity sensor
7. Black globe sensor
8. Backlight/MEM
9. SEL/Alarm
10. Down/REC
11. Earphone jack
12. Battery holder
13. Battery cover
14. 5 pin mini USB socket.
15. DC power jack

5. LCD Description

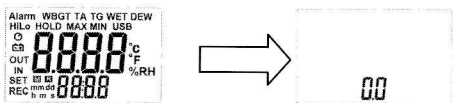


1. Alarm symbol
2. HOLD symbol
3. WBGT
4. MAX symbol
5. Air temperature
6. Black globe temp
7. Min symbol
8. Wet bulb temp
9. USB symbol
10. Dew point temp
11. Primary display
12. Temperature unit
13. Relative Humidity
14. Secondary display
15. Read & memory
16. Date symbol
17. Time symbol
18. Record symbol
19. Set symbol
20. Indoor symbol
21. Outdoor symbol
22. Low battery symbol
23. Auto power off symbol

6. Power On/Off

- Press ⏻ button to turn on or turn off the meter.
- Display all the symbol: press ⏻ button more than 1 second to turn on the meter the firmware version will soon be displayed for one second.

  Ex:



7. Auto Power Off

- Power off automatically after approx. 15 minutes without using the meter.

8. Alarm On/Off

- Press the SEL ALARM button for more than 2 second to turn on or turn off the alarm function.

※ The alarm function will be disable if the HOLD、SET、Viewing Data Records function is enabled.

9. Disable Auto Power Off

- When the power is on, press the ⏻ button for more than 2 second, to cancel or recovery automatically shutdown. Automatic shutdown feature is enabled If ↻ shows on the screen.

※ The auto power off will be disable if the SET function, USB function, Alarm is enabled.

10. LED Backlight

- ☼ MEM : Press this button once to turn on the LCD backlight. The LCD backlight automatically turns off after 15 seconds.

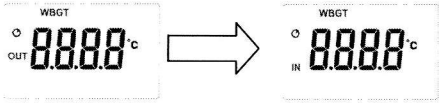
11. Temperature Unit

- Press UNIT DH button to switch the temperature to ℃/℉ unit.

12. Mode

- Press (MODE SET) button for less than 1 second to change the mode. Units switch in order of WBGT=>TA=>%RH=>TG=>WET=>DEW.
- Press (SEL ALARM) button for less than 1 second to change the IN/OUT when the LCD displays WBGT mode.

EX:



※ The mode function will be unavailable if the HOLD function and SET function is enabled.

13. Data Hold

- Press (UNIT DH) button for more than 2 seconds to enable hold function.

Ex:

※ The HOLD function will be unavailable if SET function is enabled.

14. Single Data Record

- Press (REC) button for less than 1 second to record the current measured result and the "REC" and "R" symbol will also appear on the LCD.

※ The single data record function will be unavailable if the HOLD, SET, Viewing data records function is enabled.

15. Viewing Data Records

- Press MEM button for more than 2 seconds to turn on or off the viewing data records.
- Press MAX MIN or REC button to view the number of records.
- Press MODE SET button to change the mode. (IN/OUT WBGT、TA、%RH、TG、WET、DEW)
- Press SEL ALARM button to view the date of recorded data.

  (Select the year, month, date, hours, mined, second)(TM-188D).
- Press UNIT ΩH button to switch the temperature unit.
- Press MEM button for more than 2 seconds to exit the viewing data records mode.

Ex: TM-188

TM-188D

※ The viewing data records mode will be unavailable if the HOLD, SET function is enabled.

16. AUTO DATA LOGGER(TM-188D)

- Press REC button for more than 2 seconds to turn on Auto Data logger mode, and the "REC", "R" symbol will also appear on the LCD. If you want to disable Auto Data logger mode, press REC button again for more than 2 seconds, and the "REC", "R" symbol will also disappear on the LCD.
- It is well temporarily turn off if the single data record function and the HOLD function enabled.

※ The auto data logger mode will be unavailable if the HOLD, SET function is enabled.

17. Maximum/Minimum (MAX/MIN)

- Press (MAX/MIN) button for more than 2 seconds to enter MAX/MIN mode, and the LCD will display the maximum temperature data and the "MAX" symbol.
- Press (MAX/MIN) button for less than 1 second to change maximum or minimum.
- Press (MAX/MIN) button for more than 2 seconds to exit maximum/minimum mode.

※ **The maximum/minimum mode will be unavailable if the HOLD, SET, Viewing Data Records function is enabled.**

18. USB (TM-188D)

The LCD will be displayed the "USB" symbol if the USB cable is connected.

19. Setting and Calibration

- Press (MODE/SET) button for more than 2 seconds to enter into setting mode Fig.A~L(see Table 1):

Fig. A or B setting: WBGT alarm High/Low setting:

- If you want to setup High, press (SEL/ALARM) button to select Fig.A.
- If you want to setup Low, press (SEL/ALARM) button to select Fig.**B**.
- Press (MODE/SET) button to start setting, LCD displays will flashing.
- Press (UNIT/CH) button to change temperature unit.
- Press (SEL/ALARM) button to change the digit you want to adjust.
- Press (MAX/MIN), (REC) button to change the temperature value.
- Press (MODE/SET) button to save the setting.

Fig. C setting year (TM-188D):

- z setting.

Fig. D setting month, date (TM-188D):

- Press SEL/ALARM button to select the Fig. D.
- Press MODE/SET button to start setting , LCD displays will flashing.
- Press SEL/ALARM button to select the digit you want to adjust.
- Press MAX/MIN and REC button to increase or decrease the month and data.
- Press MODE/SET button to save setting.

Fig. E setting hour, minute (TM-188D):

- Press SEL/ALARM button to select the **Fig. E.**
- Press MODE/SET button to start setting.
- Press SEL/ALARM button to select the digit you want to adjust.
- Press MAX/MIN, REC button to increase or decrease the hour and minute, the hour of the maximum value is 24 and the minimum is 00, the minute of the maximum value is 59 and the minimum is 00.
- Press MODE/SET button to save setting.

Fig. F setting second (TM-188D):

- Press SEL/ALARM button to select the **Fig.F**.
- Press MODE/SET button to start setting, LCD displays will flashing.
- Press SEL/ALARM button to select the digit you want to adjust.
- Press MAX/MIN, REC button to increase or decrease the second, the second of the maximum value is 59 and the minimum is 00.
- Press MODE/SET button to save setting.

Fig. G setting sampling interval in hours and minutes (TM-188D):

- Press SEL/ALARM button to select the **Fig.G**.
- Press MODE/SET button to start setting, LCD displays will flashing.
- Press SEL/ALARM button to select the digit you want to adjust.
- Press MAX/MIN, REC button to increase or decrease the hour and minute, the hour of the maximum value is 24 and the minimum is 00, the minute of the maximum value is 59 and the minimum is 00.

- Press MODE SET button to save setting.

Fig. H setting sampling interval in second (TM-188D):

- Press SEL ALARM button to select the **Fig.H**.
- Press MODE SET button to start setting, LCD displays will flashing.
- Press SEL ALARM button to select the digit you want to adjust.
- Press MAX MIN , REC button to increase or decrease the second, the second of the maximum value is 59 and the minimum is 00.
- Press MODE SET button to save setting.

Fig. I setting clear records:

- Press SEL ALARM button to select the **Fig.I**.
- Press MODE SET button to start setting, LCD displays will flashing.
- Press SEL ALARM button to select the NO or YES.
- If selected the YES and press MODE SET button, the records will be cleared.

Ex:

Fig. J setting air temperature offset calibration:

- Press SEL ALARM button to select the **fig.J**.
- Press MODE SET button to start setting LCD displays will flashing.
- Press SEL ALARM button to select the digit you want to adjust.
- Press MAX MIN, REC button to increase or decrease the digit, the digit of the maximum value is 9.9 and the minimum is -9.9.
- Press UNIT °F/°C button to change temperature unit.
- Press MODE SET button to save setting.

Fig. K setting Humidity offset calibration:

- Press SEL ALARM button to select the **Fig.K**.
- Press MODE SET button to start setting, LCD displays will flashing.
- Press SEL ALARM button to select the digit you want to adjust.

- Press (MAX/MIN), (REC) button to increase or decrease the digit, the digit of the maximum value is 9.9 and the minimum is -9.9.
- Press (MODE/SET) button to save setting.

Fig. L setting black globe temperature offset calibration

- Press (SEL/ALARM) button to select the **Fig .L**.
- Press (MODE/SET) button to start setting, LCD displays will flashing.
- Press (SEL/ALARM) button to select the digit you want to adjust.
- Press (MAX/MIN), (REC) button to increase or decrease the digit, the digit of the maximum value is 9.9 and the minimum is -9.9.
- Press (UNIT/DH) button to change temperature unit.
- Press (MODE/SET) button to save setting.

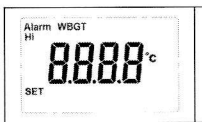
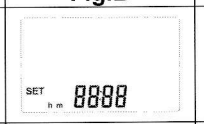
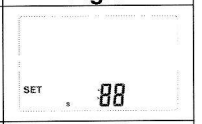


Fig.A	Fig.B	Fig.C
		
Fig.D	Fig.E	Fig.F

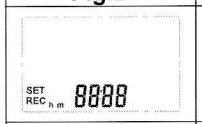
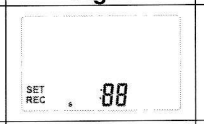
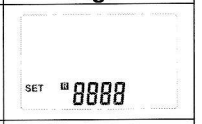

		

Fig.G	Fig.H	Fig.I

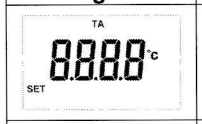
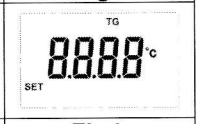

		

Fig.J	Fig.K	Fig.L

Table 1

20. Thermal hazard prevention standards

- Screening Criteria for Heat Stress Exposure (WBGT values in℃)

	Acclimatized				Not acclimatized			
Work (%)	100%	75%	50%	25%	100%	75%	50%	25%
Rest (%)	0%	25%	50%	75%	0%	25%	50%	75%
Light	29.5	30.5	31.5	32.5	27.5	29.0	30.0	31.0
Moderate	27.5	28.0	29.5	31.0	25.0	26.5	28.0	29.0
Heavy	26.0	27.5	28.5	30.0	22.5	24.5	26.5	28.0
Very Heavy	-	-	27.5	29.5	-	-	25.0	26.5

- Example of activities within Metabolic Rate Categories

Categories	Examples Activities
Resting	Sitting quietly
	Sitting with moderate arm movements
Light	Sitting with moderate arm and leg movements
	Standing with light work at machine or bench while using mostly arms
	Using a table saw
	Standing with light or moderate work at machine or bench and some walking about
Moderate	Scrubbing in a standing position
	Walking about with moderate lifting or pushing
	Walking on level at 6 Km/hr while carrying 3 Kg weight load
Heavy	Carpenter sawing by hand
	Shoveling dry sand
	Heavy assembly work on a non-continuous basis
	Intermittent heavy lifting with pushing or puling (e.g., pick-and-shovel work
Very heavy	Shoveling wet sand

According to the American Conference of Governmental Industrial Hygienists.[ACGIH](2005)

21. Precautions

- Keep the meter away from electromagnetic interference (EMI) which may cause erratic readings.
- The measured values will be inaccurate if you touch the black ball during the test.
- If the shape of black ball is being impacted to deformation, this will lead to inaccurate measured values.

22. Software installation (TM-188D)

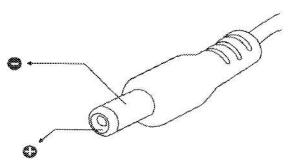
Please refer to the TM-188D installation CD execution.

23. Computer grade

- CPU : Pentium Ⅲ 1000MHZ.
- RAM : SDRAM 256MB.
- Hard disk : 200MB.
- OS : Windows 2000 , Windows XP.
- Display : 800×600 256 color.

24. External DC power

External AC to DC adapter : Voltage 9 V_{DC} (8~14 V_{DC} Max)/500mW.
Socket: Pin positive, Ground casing negative.
External diameter 5.5mm internal diameter 2.1mm .



25. Safety and maintenance standards

- Do not put this device in direct sunlight or where it is hot and/or damp.
- Operating altitude: below 2,000m.

26. Battery replacement

WARNING

If the LCD displays "[-+]"symbol, please replace the battery immediately.

Turn off the power and unplug all cables, remove the battery and replace into the new battery.
Please use the correct specification of the battery and correctly installed in the battery holder.

27. End of life

WARNING

If not using the meter, please remove the battery to avoid possible damage.

Caution: This symbol indicates that equipment and its accessories shall be subject to a separate collection and correct disposal.